

Pattern of infections in children born from HIV positive versus HIV negative women in Moshi, Tanzania

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1. Abstract

Background: This study aimed to look for patterns of infections in children born of HIV positive versus negative mothers in Moshi, Tanzania.

Methodology: In the study, 109 women and children were included. 82 were HIV negative and 27 were positive. Information on socioeconomic background and birth data was collected. The children were followed from birth to 1 year of age by physical examination. Children with HIV positive mothers were also tested for HIV at 12 and 18 months.

Results: The women had low socioeconomic status irrespective of HIV status; income was generally 15 – 30 000 TZS (13 – 26 USD) and the women had few possessions. Most women had 7 years of education. HIV positives were somewhat older ($p=0,040$) and had more children ($p=0,040$) than negatives. They were more often Christian than Muslim ($p < 0,0005$). Children born from HIV positive mothers did not appear to have higher prevalence of infections in the first year of life, although for some symptoms there was a statistical significant difference. These were cough ($p=0,002$), rash ($p=0,01$) and any illness episode ($p=0,004$) at 3 months, as well as ear discharge at 9 months ($p=0,039$).

Discussion: The number of HIV positive children in this study was too small for general conclusions to be drawn. The study did not show that children born from HIV positive mothers are more ill in the first year of life than other children. Other measures are needed to evaluate children who acquire HIV from their mothers.

2. Introduction

2.1 General background of Tanzania

Tanzania is the largest country in East-Africa. It consists of Tanzania Mainland and Zanzibar. Both the mainland and Zanzibar have experienced long periods of colonial domination and rule. The Constitution establishing the Union between Mainland and Zanzibar came into force on 26th of April 1964. Tanzania has enjoyed a long history of post-independence political and civil stability.

Tanzania has a total population of 37,7 million, of which 17,6 million are aged 15 to 49 years (2004 estimate of UN population division database). The annual population growth rate is 2,6 % (1992 – 2002). Life expectancy at birth is 47 years. Crude birth rate (births per 1000 population) is 38,4. Crude death rate is 18,2. Total fertility rate is 5,2. Infant mortality rate (per 1000 live births) is 109 and under age 5 mortality rate is 156.

The official language in Tanzania is Swahili. English is the official primary language of commerce, administration and higher education. There are also many local languages. About 78% of the population over 15 years can read either Swahili, English or Arabic (men: 85,9%, women: 70,7%).

In the mainland, 30% of the people are Christian and 35% are Muslim, while 35% have indigenous beliefs. In Zanzibar, more than 99% of the population are Muslim.

Tanzania is one of the least developed countries in the world. In 2000 the per capita Gross national product (GNP) was US\$ 280. The country is heavily dependent on the under-developed agricultural sector.

The health system in Tanzania has undergone several reforms during the last decade. Decentralisation has strengthened the district level of health services. Nevertheless, the country's poor socioeconomic situation has limited any success in improving the people's health status (1, 2).

2.2 The Kilimanjaro Region and its organisation of health services

This study was conducted in the Kilimanjaro Region in the North-East of Tanzania. It has 6 districts: Moshi urban district, Moshi Rural, Rombo, Hai, Mwanga and Same. The population is approximately 1,3 million (2002 numbers from Professor Babill Stray-Pedersen).

Moshi urban district is the capital of this region, and has about 230 000 inhabitants. 64 000 of these are women of child bearing age (15 – 49 years) and 31 500 are children under 5 years.

Moshi urban district has one referral hospital; Kilimanjaro Christian Medical Center (K.C.M.C). It has one district hospital; Mawenzi hospital. In addition, 6 government primary health care centres provide antenatal care, family planning services, immunisation and monitoring of child growth. The primary health care centres are the first point of care. Difficult cases are referred to Mawenzi hospital, and if necessary, from Mawenzi to K.C.M.C. The two hospitals and 2 of the primary health care centres; Pasua and Majengo, offer delivery services. The information used in this study was collected from women and children attending Pasua and Majengo health care centres in May and June 2004.

Majengo health care centre serves a population of about 61 700 people. Of these, 17 150 are women aged 15 – 49. 8 450 are children under 5 years. Pasua health care centre is smaller, as it serves a population of about 31 360. It has 8 720 women aged 15 – 49 years and 4 300 children under 5 years.

There are about 6 000 deliveries per year at Moshi urban district. Most are at Mawenzi district hospital (3500) or K.C.M.C (2000). About 250 are at Pasua and 250 at Majengo. Women with risks are referred early to deliver at a hospital with more trained personnel and resources.

2.3. The disease burden and HIV epidemic of Tanzania

The health status of people in Tanzania is probably among the lowest in Africa, when compared to countries with similar economy. Poverty is a major issue impacting on health, as 51% of the population is living below the poverty line. Other problems are low literacy rate, gender imbalances, lack of clean water and sanitation, drug abuse, dense population and an increasing number of refugees. The low health status is mostly caused by preventable diseases such as HIV and AIDS, malaria, tuberculosis, reproductive disorders, childhood disorders and some non-infectious diseases (1).

HIV and AIDS have become a great threat to Tanzania's development, both socio-economically and when it comes to security and health. More than half of the hospital beds in Tanzanian hospitals are occupied by AIDS-infected persons. HIV and AIDS is leading to increased health costs, rising infant and childhood mortality, poverty and an increasing number of orphans.

At the end of 2003, 1,5 million Tanzanian people were living with HIV or AIDS. The adult rate of infection (age 15 – 49) was estimated at 8,8% (6,4 – 11,9, 95% CI). Social circumstances cause women to contract HIV more frequently than men. Therefore it is probable that more women than men are infected. Women pass on HIV to their children; 70 000 to 80 000 newborns contract HIV annually from their HIV positive mothers (National AIDS Control Programme). This reverses the trends of reductions in infant and under-five mortality as well as the mean life expectancy.

During the past few years there has been a great national response to the epidemic. The President of the United Republic of Tanzania has declared HIV / AIDS as a national disaster and several programmes and working groups to fight the epidemic have been created (1, 2).

Other infectious diseases of importance in Tanzania are lymphatic filariasis, tuberculosis, leprosy and onchocerciasis. Non-infectious diseases as diabetes mellitus,

hypertension and cardiovascular diseases are becoming a greater problem as lifestyle is changing.

2.4. Child morbidity and mortality

In developing countries, 1 out of 7 children die before they are 5 years old, 2/3 of these die before they reach the age of 2. It has been estimated that 4 infectious diseases; pneumonia, diarrhoea, malaria and measles, cause 50% of deaths in children under 5. Often, these children are also malnourished, contributing to 54% of infant deaths. This brings the total deaths due to these 5 conditions to 70%. In addition, vertical transmission of HIV is becoming more important (3).

Every year, acute respiratory infections kill over 2 million children under age 5 worldwide. Up to 40% of all children seen in health clinics have an acute respiratory infection. Pneumonia is usually diagnosed clinically by observing the child for 2 key signs; chest indrawing and fast breathing. Children suffering from malnutrition or measles are particularly susceptible to pneumonia. In Tanzania, 14% of under-fives have an acute respiratory infection (1998 – 2003) (4, 5).

Diarrhoea is a great problem in underdeveloped countries, and over 2 million of the world's children die from diarrhoeal disease every year. It may cause life-threatening complications such as dehydration and malnutrition. In Tanzania, only 73% of the total population have access to improved drinking water. 46% of the total population use adequate sanitation (2002). WHO and the Division of Child Health and Development have taken the initiative for using an integrated approach to diseases like diarrhoea in Tanzania. Still, only 38% of under-fives with diarrhoea receive oral rehydration and continued feeding (1994 – 2003) (6).

Malaria is a major cause of childhood deaths in Tanzania. Young children, especially infants under 2 years, are at particular risk of dying from malaria, as they have not yet developed the partial immunity that results from going through several infections. As fever may be the only sign of malaria, it may be difficult to distinguish from other conditions. In addition, malaria causes serious problems due to anaemia. 100 000 – 125 000 Tanzanian people die from malaria every year, 80 000 of these are children under 5 years.

Measles infects over 40 million children and kills over 800 000 under 5 every year worldwide (10). Immunisation is the most important way of preventing deaths from measles. In Tanzania 97% of 1 year olds are fully immunized (2003), and so measles is becoming less prevalent (3, 4, 7).

Malnutrition is rarely the direct cause of childhood death. Still, malnutrition contributes in more than half of all cases. Lack of food is often combined with poor feeding practices and infection. In addition, infection undermines nutritional status. 13% of Tanzanian newborns have low birthweight (less than 2500 grams), whereas in Norway the corresponding number is 5%. In Tanzania, 29% of children under 5 are suffering from moderate to severe underweight (1995 – 2003). 5% in the same group are moderately or severely wasted and 44% are moderately or severely stunted (4).

2.5. Presentation and detection of paediatric HIV infection

Up to 45% of HIV-infected children may develop AIDS and die within 2 years of age. In general, children with HIV have a more severe course of disease than adults. In a Rwandan study, the estimated risk of death at 1 year was 260 (160 – 410, 95% CI) per 1000 live births. Uninfected children born to HIV+ mothers was 20 (10 – 70, 95% CI) per 1000, about the same as for uninfected mothers (50 (30 – 90, 95% CI) per 1000) (8).

The clinical presentation of paediatric HIV infection in African children is usually unspecific and has the same features as common paediatric infections. Therefore, most of the

children who die from AIDS in Africa, die without confirmation of HIV as the underlying reason. In children born to HIV positive mothers, maternally acquired HIV antibodies (IgG) persist for 15 to 18 months after birth. A positive antibody test in a child under 18 months of age confirms exposure to maternal infection, but one can only use clinical signs as an indicator of whether the child is infected or not.

In Africa, it is not always possible to use complicated facilities for diagnosis, such as microbiology, virology, echocardiography and radiology. As noted in the previous chapter, indicators such as pneumonia, diarrhoea, anaemia, wasting and meningitis are frequent in children who are not infected with HIV. The prevalence of these indicators may therefore not be useful to predict HIV-infection. It has been shown that the severity and duration of the diseases is what differs among HIV positive and negative children (9, 10).

A study from Durban, South-Africa, showed that respiratory tract infections occur more frequently in HIV positive children than in negative children. *Pneumocystis carinii* is a frequent and serious cause of pneumonia in HIV infected children. This is true in both industrialized countries and in developing countries. If an infant of less than 6 months has severe pneumonia with hypoxia and fails to respond to common antibiotics, *Pneumocystis carinii* pneumonia should be considered (11).

HIV positive children in Africa often suffer from chronic respiratory symptoms that are hard to diagnose. Many actually have HIV related lymphoid interstitial pneumonia. Other possible causes may be Kaposi's sarcoma and bronchiectasis or even cardiac disorders. Malaria and HIV both cause immunosuppression, but studies have not shown significant interactions between them (9).

In a study of 2015 hospitalized children in Dar es Salaam, Tanzania, the symptoms fever, cough, ear discharge, diarrhoea, oral ulcers and skin rash were significantly more common in HIV infected than in uninfected children when they lasted for 14 days or more. In the multivariate analysis cough, ear discharge, oropharyngeal ulcers and skin rash were found to be the most important symptoms. When it comes to clinical signs, wasting, stunting, hair changes, oral thrush, oropharyngeal ulcers, lymphadenopathy, lung crepitations and lung consolidations were significantly associated with HIV infection in the univariate analysis. In the multivariate analysis, oral thrush, lung crepitations, cervical lymphadenopathy, wasting and inguinal lymphadenopathy were the most important signs. The three most common diagnoses were for HIV positive children acute respiratory infection, malnutrition and tuberculosis. For HIV negative children the most common diagnoses were malaria, acute respiratory infections and malnutrition. This study concluded that there was a strong positive association between several symptoms and signs that are included in the definition of AIDS in children, but that laboratory testing was needed to make a definitive diagnosis because the same symptoms and sign often occur in uninfected children in Africa (12).

Malnutrition or wasting may be due to undernutrition. But if this is not the case it may be directly caused by HIV infection. Often, African children suffer from both HIV and malnutrition at the same time (13).

3. Objectives

The main objective of this study was to look for patterns of infections in children born from HIV positive versus HIV negative women in Moshi, Tanzania. The study aimed to:

1. Decide whether frequencies of infections are higher in children born from HIV positive mothers than in children born from HIV negative mothers.
2. Study patterns of infections in children that are found to be HIV positive.
3. Decide whether various circumstances listed below, play a role in the frequency of childhood illnesses.
 - a. Education
 - b. Working outside of the home
 - c. Marital status
 - d. Income / economical status
 - e. Religion

4. Methodology

4.1. Design

This study was done as a part of the medical degree at the University of Oslo. Part of the study was based on a prospective cohort study by Sia Msuya, MD, Rikshospitalet in Oslo. This study will further on in this paper be referred to as “the main study”.

Field work was done at the same time and at the same clinics as 2 other students: Hege Holmberg and Ragnhild Gulsvik.

The topic of this study was chosen to involve HIV and childhood illnesses, especially infections, in the first year of life. As HIV / AIDS is a relatively “new” disease joining the well-known problems in underdeveloped countries, it would be interesting to examine how HIV is changing the picture of child health in Tanzania.

4.2. Study sites

The study was performed in Moshi urban district in the Kilimanjaro region of Tanzania. Field work was conducted in Pasua and Majengo primary health centres. These clinics are described in the introduction section.

4.3. Population

Women and children attending Pasua or Majengo clinics in the time period of our stay were included in the study. Only women and children who were enrolled in the main study were included. They were asked by nurses working in the clinics if they would like to participate.

Inclusion criteria:

- 1) Women and children included in the main study.
- 2) HIV result of mother must be known from serologic testing.
- 3) Child must have attended at least 3 follow-up sessions.

Exclusion criteria:

- 1) Women who were not enrolled in the main study.
- 2) Children under 3 months of age.

The patients in the main study did not have scheduled appointments, but were told to come back at specific time intervals: They were followed up regularly from birth of the child and at 1 month, 3 months, 6 months, 9 months, 12 months, 15 and 18 months.

4.4. Tools

4.4.1. Questionnaire

The questionnaire aimed to collect:

- 1) Demographic information
- 2) Information on children
- 3) Information on growth of the child from 0 to 12 months
- 4) Information on signs of infections in the first 12 months of life

The demographic information included the age of the mother and clinic attended. Educational level of the mother in years of completed schooling was also recorded. The women were asked whether they had a job or not, and if they did, what this job consisted of. Further questions about marital status and religion were included. There were questions about possessions and income in Tanzanian Shillings, to try and see if there was any difference in the economical status in the group of women attending the clinics. The question about income was asked in the following way: “How much do you and / or your partner make per month in Tanzanian Shillings (TZS)?” This was to get a picture of household income in the cases where the woman was unemployed.

The information on children consisted of asking the mother how many children she had and how many had died before the age of 5.

Growth monitoring was done by filling out tables with information on weight, length and head circumference. Each parameter was recorded at birth, 1 month, 3 months, 6 months, 9 months and 12 months where information was available. This information was not used for further analysis as many values were missing from the clinical records.

Information on sign of infections was recorded at 1 month, 3 months, 6 months, 9 months and 12 months. The signs recorded aimed to cover the most common signs of infections in infants. Diarrhoea, fever, cough, ear discharge, oral thrush or ulcer and rashes were selected as parameters. In addition, the parameter “any kind of illness symptom” was selected. Admission to hospital was also recorded.

4.4.2. Clinical records

As the time for field work for this study was limited to 6 weeks, the clinical records from the main study were used to fill in weight, length and head circumferences for previous visits. The clinical examination sheets were also used for information about signs of infections earlier in life.

4.4.3. Measurements

The children were weighed in kilograms (kg) using a Salter scale. Length was measured in centimetres (cm) using a tape measure and a measuring board. Head circumference was measured in cm with a tape measure.

4.4.4. Laboratory data

The results obtained from the main study were collected. In this study, both the women and children were tested for HIV using 2 rapid tests: Within 6 hours of collection, blood was centrifuged on site and serum was tested. First with Determine HIV1 / HIV 2 (Abbott Laboratories), then with Capillus HIV 1 / HIV 2 (Trinity Biotech). HIV was diagnosed when both tests were positive. In case of discordance between the 2 tests, a third test, the ELISA test; Virinostika HIV Uni-form II (Organon Teknika) was used. The children were diagnosed at 18 months of age, although tests were also taken at 12 months and 24 months. As some of the children were younger than 18 months during my stay in Moshi, information on the child’s HIV status has for some children been collected later on. This was done by matching my study number with the same child’s study number in the main study.

4.4.5. Statistical analysis

Statistical analysis of the data was done using the SPSS program (Statistical Package for Social Sciences, SPSS inc., Chicago, Illinois, USA). Correlations were tested using the Pearson Chi-Square test. This is an asymptotic test and only valid where at least 80% of the cells have expected count ≥ 5 and where the minimum expected count in all cells must be ≥ 1 .

Where this test was not valid, Fisher's Exact Test was used. Significance level was chosen at 0,050.

4.5. Time schedule

Field work was done during 6 weeks in 2004 (May and June). About 3 weeks (Monday to Friday) were spent in each clinic. The time of activity in the clinics varied widely from day to day, usually there were patients present from 10 am to 2 pm. The number of patients attending the clinics per day was anywhere from 2 to 30. Analysis and completion of the paper was done during 6 weeks in 2005 (August and September).

4.6. Ethical clearance

The main study was ethically approved by the Tanzanian Ministry of Health and the Norwegian Ethical Committee. The women were orally consented to join this study as a sub-study in addition to the main study.

5. Results

5.1. Demographic data of the mothers

Results are shown in table 1: Demographic information. In total, 109 women were included in the study. Of these, 27 were HIV positive and 82 were HIV negative. About 3 out of 4 women attended Pasua clinic, while 1 out of 4 attended Majengo.

There was little difference in socioeconomic factors between the groups of HIV positive and negative women: Almost 90% of the women had completed 7 years of education, both in the HIV positive and in the HIV negative group. Some had 1 to 6 years of education, but very few had no education at all. Only one woman (HIV negative) had secondary education.

Of the women in total, 41,3% had a job that provided income. A few more HIV positive women (55,6%) than HIV negative women (36,6%) had a job, although the difference was not significant. The most common type of work was small business: some were fishmongers, some sold fruit, cakes or other foods. 2 were teachers and 2 were farmers, 2 were tailors. One was a cleaner and one was a health worker.

In total, 78% of the women were married, the rest were either single or cohabiting. Most of the HIV negative women were married (87, 7 %), but this was only true for 33, 3 % of the positive women. Among the HIV positive women there were 33, 3 % singles. There was a strong significant association between HIV status and marital status, the significance was $< 0,0005$ using Fisher's Exact Test.

Islam was the most common religion overall, but 45% were Christian. None of the women had a traditional religion. About 2 out of 3 HIV positive women were Christian and 1 out of 3 was Muslim. In the HIV negative group, the ratio was the opposite: 2 out of 3 were Muslim and 1 out of 3 was Christian. There was a strong significant association between HIV status and religion. The significance was less than 0,0005 using Fisher's Exact Test.

As for possessions, 90% of the women owned a radio. Only 1 out of 3 had a bicycle and very few had a car. There was a difference in the groups of HIV positive and negative women: In the HIV negative group, 93,9% owned a radio and 37,8% owned a bicycle. In the HIV positive group, 48,1% owned a radio and 11,1% owned a bicycle. There was a significant association between HIV status and owning a radio or bicycle (sig.: $< 0,0005$ and 0,009).

45% of the women had access to electricity at home. Only 18,3 % of the women owned the house or apartment they lived in. The rest were renting, a few were living with their parents or had other agreements. There was a difference between the HIV positive women and the HIV negatives, although it was not significant.

Most of the women had an income of 15 000 to 30 000 TZS per month. This is about 13 USD or 85 NOK) None had an income of more than 30 000 TZS per month. Some had no income at all. More positive than negative women had no income or the lowest group of income, although the difference was not significant.

The mean age of the women as a whole group was 26,4 years. Range was 17 to 45 years. The HIV positive women were a little older (30,2 years). The difference was significant (sig.: 0,040, Fisher's Exact Test). They also had more children 3,1 (total group had 2,2 children each). The significance rate was 0,040 using Fisher's Exact Test. The women in the HIV positive group had lost more children under 5 than the group as a whole (0,4 children in the positive group, 0,2 children in the whole group). Although there was a small numeric difference, it was not significant.

Table 1:	<i>HIV - positive</i>		<i>HIV - negative</i>		<i>Total</i>		<i>HIV positive > HIV negative?</i>	<i>Test: Chi-Square/ Fisher's Exact</i>	<i>Sig. 2 - sided</i>
Demographic information	<i>N</i>	<i>%</i>	<i>N</i>	<i>%</i>	<i>N</i>	<i>%</i>			
<i>Participants</i>	27	24,8 %	82	75,2 %	109	100,0 %			
<i>Clinic</i>							Majengo > Pasua	Chi-Square	0,235
Majengo	9	33,3 %	18	66,7 %	27	100,0 %			
Pasua	18	22,0 %	64	78,0 %	82	100,0 %			
Total	27	24,8 %	82	75,2 %	109	100,0 %			
<i>Education (years)</i>								Fisher's Exact	0,511
0	0	0,0 %	1	1,2 %	1	0,9 %	No		
1 to 6	3	11,1 %	6	7,3 %	9	8,3 %	Yes		
7	24	88,9 %	74	90,2 %	98	89,9 %	No		
> 7	0	0,0 %	1	1,2 %	1	0,9 %	No		
Total	27	100,0 %	82	100,0 %	109	100,0 %			
<i>Work outside of home</i>								Chi-Square	0,082
No	12	44,4 %	52	63,4 %	64	58,7 %	No		
Yes	15	55,6 %	30	36,6 %	45	41,3 %	Yes		
Total	27	100,0 %	82	100,0 %	109	100,0 %			
<i>Marital status</i>								Fisher's Exact	<0,0005
Married	13	48,1 %	72	87,8 %	85	78,0 %	No		
Cohabiting	5	18,5 %	4	4,9 %	9	8,3 %	Yes		
Single	9	33,3 %	6	7,3 %	15	13,8 %	Yes		
Total	27	100,0 %	82	100,0 %	109	100,0 %			
<i>Religion</i>								Fisher's Exact	<0,0005
Muslim	9	33,3 %	50	61,0 %	59	54,1 %	No		
Christian	17	63,0 %	32	39,0 %	49	45,0 %	Yes		
No religion	1	3,7 %	0	0,0 %	1	0,9 %	Yes		
Total	27	100,0 %	82	100,0 %	109	100,0 %			
<i>Possessions</i>									
Radio	13	48,1 %	77	93,9 %	90	(some had several)	No	Fisher's Exact	<0,0005
Bicycle	3	11,1 %	31	37,8 %	34	(some had several)	No	Chi-Square	0,009
Car	1	3,7 %	3	3,7 %	4	(some had several)	Equal	Fisher's Exact	1
<i>Access to electricity at home</i>								Chi-Square	0,065
Yes	8	29,6 %	41	50,0 %	49	45,0 %	No		
No	19	70,4 %	41	50,0 %	60	55,0 %	Yes		
Total	27	100,0 %	82	100,0 %	109	100,0 %			

Table 1 continued	<i>HIV - positive</i>		<i>HIV - negative</i>		<i>Total</i>		<i>Hiv positive > HIV negative</i>	<i>Test: Chi-Square/ Fisher's Exact</i>	<i>Sig. (2-sided)</i>
	<i>N</i>	<i>%</i>	<i>N</i>	<i>%</i>	<i>N</i>	<i>%</i>			
<i>Owens house / apartment</i>								Fisher's Exact	0,391
Yes	3	11,1 %	17	20,7 %	20	18,3 %	No		
Renting / other	24	88,9 %	65	79,3 %	89	81,7 %	Yes		
Total	27	100,0 %	82	100,0 %	109	100,0 %			
<i>Income</i>								Fisher's Exact	0,235
0	5	18,5 %	10	12,2 %	15	13,8 %	Yes		
< 5000 TZS	2	7,4 %	5	6,1 %	7	6,4 %	Yes		
5000 - 10 000 TZS	4	14,8 %	11	13,4 %	15	13,8 %	Yes		
10 000 - 15 000 TZS	9	33,3 %	16	19,5 %	25	22,9 %	Yes		
15 000 - 30 000 TZS	7	25,9 %	40	48,8 %	47	43,1 %	No		
> 30 000 TZS	0	0,0 %	0	0,0 %	0	0,0 %	Equal		
Total	27	100,0 %	82	100,0 %	109	100,0 %			
	<i>mean</i>	<i>range</i>	<i>mean</i>	<i>range</i>	<i>mean</i>	<i>range</i>			
<i>Age mother (years)</i>	30,2	(17 - 45)	25,1	(17 - 45)	26,4	(17 - 45)	Yes	Fisher's Exact	0,040
<i>Number of children</i>	3,1	(1 - 7)	1,9	(1 - 5)	2,2	(1 - 7)	Yes	Fisher's Exact	0,040
<i>Children died before 5 yrs</i>	0,41	(0 - 5)	0,13	(0 - 2)	0,2	(0 - 5)	Yes	Fisher's Exact	0,105

5.2. Age and sex of the children

109 children were enrolled in the study, 50% were boys and 50% were girls. The mean age of the children was 13,3 months. Minimum was 3 months and maximum was 24 months.

5.3. HIV status and mortality of children

Twenty seven children were born from HIV positive mothers. They were tested for HIV at 12, 18 and 24 months. 2 children died before test results were available, 1 at birth and one at 7 months. 2 were positive at 12 months but test results were not available for 18 months. 1 was positive at 18 months. 4 children had no available results. 18 of the children were HIV negative at 18 months. In total, 22 children therefore had valid results (counting the 12-months results for 2 positive children), and of them, 18 (86, 4%) were HIV negative while 3 (13, 6%) were HIV positive.

3 of the children born from HIV positive mothers were dead by September 2005. One of these were tested HIV positive and died at 15 months of age. One died at 7 months, that is, before testing, and one died at birth. 3 of the children did not come for follow-up at all and it is therefore uncertain whether they are alive or not.

The HIV positive children and the child that died before results were available are described in chapter 5.5 as separate case studies.

5.4 Patterns of infection

For many symptoms there was an increased prevalence of symptoms in the group of children born from HIV positive mothers. This is most obvious when symptoms are added as the variable “illness episodes at all” and in the variable “hospitalizations”. However, most of the differences were not significant.

Significant differences were found for cough at 3 months (exact sign: 0,002) and rash at 3 months (exact sign: 0,010). For and any illness episodes at 3 months (asymptotic sign: 0,004), ear discharge at 9 months (exact sign: 0,039) and cough at 12 months (exact sign: 0,097) the outcomes were close to significant.

See table 2: Patterns of infections at 1, 3, 6, 9 and 12 months depending on mother’s HIV status.

Table 2: Patterns of infections at 1, 3, 6, 9 and 12 months depending on mother's HIV - status

	<i>HIV + mother</i>			<i>HIV - mother</i>			<i>Total</i>			<i>HIV pos > HIV neg</i>	<i>Sig. (2-sided) Fisher's Exact Test</i>
	<i>N</i>	<i>N obs</i>	<i>%</i>	<i>N</i>	<i>N obs</i>	<i>%</i>	<i>N</i>	<i>N obs</i>	<i>%</i>		
<i>1 month</i>											
Diarrhoea	1	26	3,7	3	81	3,8	4	107	3,7	No	1,000
Fever	3	26	11,5	5	81	6,2	8	107	7,5	Yes	0,399
Ear discharge	1	26	3,8	3	81	3,7	4	107	3,7	Yes	1,000
Cough	4	26	15,4	7	81	8,6	11	107	10,3	Yes	0,456
Oral thrush	2	26	7,7	1	81	1,2	3	107	2,8	Yes	0,146
Rash	0	26	0	0	81	0	0	107	0	No	-
Ill at all	9	26	34,6	19	80	23,9	28	106	26,4	Yes	0,275*
Hospitalized	2	26	7,7	4	80	5,0	6	106	5,7	Yes	0,634
<i>3 months</i>											
Diarrhoea	3	25	12,0	3	82	4,9	7	107	6,5	Yes	0,350
Fever	4	25	16,0	4	82	4,9	8	107	7,5	Yes	0,084
Ear discharge	0	25	0	1	82	0,9	1	107	0,9	No	1,000
Cough	10	25	40,0	9	82	11,0	19	107	17,8	Yes	0,002
Oral thrush	2	25	8,0	0	82	0	2	107	1,9	Yes	0,053
Rash	4	25	16,0	1	82	1,2	5	107	4,7	Yes	0,010
Ill at all	13	25	52,0	18	81	22,2	31	106	29,2	Yes	0,004*
Hospitalized	2	25	8,0	1	81	1,2	3	106	2,8	Yes	0,138
<i>6 months</i>											
Diarrhoea	3	22	13,6	13	77	16,9	16	99	16,2	No	1,000
Fever	6	22	27,3	13	77	16,9	19	99	19,2	Yes	0,357
Ear discharge	2	22	9,1	1	77	1,3	3	99	3,0	Yes	0,123
Cough	6	22	27,3	14	77	18,2	20	99	20,2	Yes	0,374
Oral thrush	1	22	4,5	0	77	0	1	99	1,0	Yes	0,222
Rash	3	22	13,6	4	77	5,2	7	99	7,1	Yes	0,182
Ill at all	13	22	59,1	34	77	44,2	47	99	47,5	Yes	0,216*
Hospitalized	2	22	9,1	3	77	3,9	5	99	5,1	Yes	0,307

Table 2 continued	<i>HIV + mother</i>			<i>HIV - mother</i>			<i>Total</i>			<i>HIV pos ></i>	<i>Sig. (2-sided)</i>
	<i>N</i>	<i>N obs</i>	<i>%</i>	<i>N</i>	<i>N obs</i>	<i>%</i>	<i>N</i>	<i>N obs</i>	<i>%</i>	<i>HIV neg</i>	<i>Fisher's Exact Test</i>
<i>9 months</i>											
Diarrhoea	3	19	15,8	14	71	19,7	17	90	18,9	No	1,000
Fever	7	19	36,8	13	71	18,3	20	90	22,2	Yes	0,119
Ear discharge	2	18	2,2	0	71	0	2	89	2,2	Yes	0,039
Cough	8	18	44,4	20	71	28,2	28	89	31,5	Yes	0,184 *
Oral thrush	1	19	5,3	0	71	0	1	90	1,1	yes	0,211
Rash	1	19	5,3	1	71	1,4	2	90	2,2	Yes	0,380
Ill at all	10	20	52,6	33	71	46,5	43	91	47,8	Yes	0,633*
Hospitalized	3		15,0	4		5,6	7		7,7	Yes	0,176
<i>12 months</i>											
Diarrhoea	1	15	6,7	10	68	14,7	11	83	13,3	No	0,679
Fever	5	16	31,3	16	68	23,5	21	84	25,0	Yes	0,532
Ear discharge	1	16	6,3	2	68	2,9	3	84	3,6	Yes	0,474
Cough	6	15	40,0	13	68	19,1	19	83	22,9	Yes	0,097
Oral thrush	0	15	0	0	68	0	0	83	0	No	-
Rash	0	15	0	2	68	2,9	2	83	2,4	No	1,000
Ill at all	8	15	53,3	28	68	41,2	36	83	43,4	No	0,390*
Hospitalized	1	16	6,3	8	67	11,9	9	83	10,8	No	1,000

* Pearson Chi-Square test was valid in these cases and was used for analysis. All other figures were calculated using Fisher's Exact test.

5.5 Case studies: HIV positive children

5.5.1: Case number 79

This case was a female child of 19 months at examination. She came in with her mother who was HIV positive, for a check-up with Dr. Jacqueline Uriyo, paediatrician working in the main study. The child was tested HIV positive at 18 months of age. She had not been ill during the first year of life, other than having a cough at 12 months of age. This did not require hospitalization. The child is still alive and is now 36 months old.

The child's mother was a woman of 28 years attending Majengo clinic. She had completed 7 years of primary school and had no job or income. She was single and a Christian. She did not own a radio, a bike or a car, and she was renting the apartment she lived in. She had 2 children including the girl in the study and had not lost any children under 5 years.

5.5.2: Case number 7

This was a 10 month old boy, born from a woman attending Pasua clinic. His mother was 30 years old and had completed 7 years of primary school. She worked as a shoe seller and earned 10 – 15 000 TZS per month. She was married and a Christian. She had 4 children all together and all were alive in May 2004.

The child tested positive for HIV at 12 months, but died before testing at 18 months. He had suffered repeated infections during his first year of life, especially in the first month and between 6 and 9 months of age. He had cough, diarrhoea, fever, ear discharge, oral thrush and rash. He was hospitalized at 6 months and 9 months for diarrhoea and flu. He died at 15 months of age.

5.5.3: Case number 13

This was a 7 month old boy who came in at Pasua Clinic with his mother in May 2004. His mother was mentally retarded. She was 30 years old, had 4 years of schooling and worked as a food-vender. She earned 10 – 15 000 TZS monthly. She was single and had no other children than the one included in the study. She had lost 5 children in the past.

The child in the study was seriously ill at 3 months with diarrhoea, cough and oral thrush. He was admitted to hospital and survived. Nevertheless, he died at 7 months of unknown reason. The child's HIV status was unclear due to young age.

5.5.4: Case number 20

This case was female child, 5 months old at examination. She was tested HIV positive at 12 months of age. Results for 18 months are not available. The child had a few weeks with fever and cough at 3 months of age, but has otherwise been well. The child is alive today, 2 ½ years old. The child has 2 older siblings, none dead.

The mother lives in the Pasua area; she is 35 years old and has completed 7 years of school. She is single, a Christian and works as a fruit seller. She makes between 15 000 and 30 000 TZS per month.

6. Discussion

6.1 Weaknesses of methodology

Study sites were both in urban district of Moshi. The results from this study can therefore only give information about the situation in an urban district. Both socioeconomic situation and prevalence of infectious diseases could be different in rural areas and in other climate zones.

Time of data gathering was limited to 6 weeks. This means that the study had a small sample size and might fail to find associations where they might be present. All in all, only 3 children were found to be HIV positive, although 3 more died.

Clinic nurses helped translate the questionnaires used, but there was a language barrier in translating back from Swahili to English as the nurses had limited English skills. It was in some cases difficult to get a complete picture of the extent of the illness episodes.

The main study included examination of the children every 3 months. The mothers therefore reported illness episodes and described the symptoms involved since the last visit. It might be hard to remember that the child was ill after it regained its health; this might lead to under reporting.

The children of HIV positive mothers were offered extra examinations every month. They therefore had closer follow-up and more opportunities to report disease. In addition, the HIV positive women might be biased as they knew their HIV status. They might expect more disease in their child and therefore be more attentive. On the other hand, HIV negative women may be less worried about disease and consider their children at lower risk because they are HIV negative.

Clinical records from the main study were used to gather data from previous examinations. This was problematic because the records had some missing data. In some cases, the children had skipped examinations. In other cases the children had only some for weighing and immunisations. This means that they had participated in the usual health care program in the area, but not some in for the study examination.

6.2 Demographics

As mentioned in the introduction section, Tanzania is one of the world's least developed countries. Poverty places a great burden on the people of Tanzania. This is true also for the women and children who participated in this study: The mean income, for both HIV positives and negatives, was 15 – 30 000 TZS per month. This is about 180 Norwegian kroner, a tiny sum in Norwegian standards. This is what a mother and her family have to live on for a month. Consequently, nutrition, hygiene and other factors that promote health must be sparse.

Despite this, most women in the study were fully educated at primary school level, and this is a result of the government's prioritising of education for the masses.

The study showed that more HIV negative women than positive women were married. This could be caused by the husband leaving after knowing the woman's HIV status. It could also mean that a single woman has higher risk of HIV infection due to more sex partners.

The study also showed that HIV positive women more frequently were Christian than HIV negative women. This could be due to different sex practices in the two religious groups.

HIV positive mothers were a little older than the HIV negative women. This could be because older women have had more time for sexual activity, more partners and therefore higher risk of contracting HIV. The higher number of children among older mothers is probably also caused by more fertile years.

6.3 HIV and infections

Most studies have been performed on children with known HIV status, and one has compared HIV positive children with negative children. In this study, HIV status of most of the children was not known at the time the field work was performed. Therefore, HIV status of the mother was used to separate the children in 2 groups.

Statistical analysis showed that most symptoms were not significantly associated with HIV status of the mother. Exception to this was cough, rash and any illness episode at 3 months of age, as well as ear discharge at 9 months. Cough at 12 months was close to significantly associated (sig. = 0,097).

Studies have found respiratory tract infections to be more prevalent among HIV positive children than negative children (9, 11), but this study can not conclude that the same is true for children born by HIV positive mothers.

As mentioned earlier, children in underdeveloped countries are at high risk of infections independent of their HIV status, and this makes it challenging to find specific symptoms and signs that can predict the child's HIV status (9).

The cases described were widely different. The first one, an HIV positive girl of 19 months, showed that children with HIV can appear relatively healthy, even at 1 ½ years of age. On the other hand, case number 7 from the study, showed a 10 month old boy who had suffered repeated infections in the first year of life. His symptoms came from several organ systems and were unspecific; they did not show any typical pattern. The child died before his first birthday, like many children with HIV (8).

Case number 13 was different because the mother was mentally retarded. She had lost 5 children in the past, and one can discuss whether this was due to lacking skills in taking care of a child, as well as having a positive HIV status.

The last case showed a girl born from an HIV positive mother. The girl had IgG-antibodies at 12 months; therefore, she might be infected. This is not sure, because it is possible that the antibodies are from the mother. At 18 months, all maternal antibodies are cleared (9), and results would be certain. In this case, 18 month results were unfortunately not available.

6.4 Conclusion

Tanzania is one of the world's least developed countries. The HIV and AIDS epidemic is reversing any improvements that have been made in the health status of the Tanzanian people. In this study, 109 mothers and their children were interviewed and examined in Moshi, Tanzania. It showed that the people in general, HIV positive or negative, generally are very poor. Income is low, often 15 000 to 30 000 TZS per month per household. Still, the people are relatively well educated as most people have completed 7 years of primary school. Although statistical analysis of the data from the study found some differences in socioeconomic status between HIV positive and negative women, the number of cases analysed was too small to make any general conclusions.

The children in the study were followed for 1 year and observed for symptoms of infection. The results showed that the children often had symptoms of infection, but this was generally not associated with the mother's HIV status. Although there were some exceptions, generalisations can not be made. This means that other methods than observing tendency of infection are required to select which children have contracted HIV from their mothers.

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9. Appendix

Questionnaire

1. ID-number Fride:
2. Study number (main study):
3. HIV-status of mother:
 - 3.1. +
 - 3.2. –

Background information mother

4. Age of mother (years):
5. Educational level (years completed):

5.1. Primary school	1	2	3	4	5	6	7
5.2. Secondary school	1	2	3	4			
5.3. Secondary high school	1	2					
5.4. College / university		1	2	3	4	5	6
6. Do you have a job that provides income?
 - 6.1. Yes (→ qu 7)
 - 6.2. No (→ qu 8)
7. Job:
8. Marital status:
 - 8.1. Single
 - 8.2. Cohabiting
 - 8.3. Married
9. Religion:
 - 9.1 None
 - 9.2 Christian
 - 9.3 Muslim
 - 9.4 Traditional religion
 - 9.5 Other, please specify
10. Economical status
 - 10.1 Material possetions. The mother owns a:
 - 10.1.1 Radio
 - 10.1.2 Bike
 - 10.1.3 Car
 - 10.1.4 Fridge
 - 10.1.5 Telephone
 - 10.1.6 Television
 - 10.2 Do you have electricity at home?
 - 10.2.1 Yes
 - 10.2.2 No
 - 10.3 Do you (and your partner) own the house you live in?

10.3.1 Yes

10.3.2 No

10.4 What is your and / or your husband's monthly income?

10.4.1 0 Tsh

10.4.2 < 5000 TSh

10.4.3 5 – 10 000 TSh

10.4.4 10 – 15 000 Tsh

10.4.5 15 – 30 000 TSh

10.4.6 > 30 000 TSh

Information on the lastborn child

11 HIV-status of child at 12 months:

11.1 +

11.2 -

12 Is the lastborn child living?

12.1 Yes (→ qu 14)

12.2 No (→ qu 3)

13 Age of lastborn at death (months):

14 Age of child (months):

	Birth	1 mo	3 mo	6 mo	9mo	12 mo
Weight (kg)						
Length (cm)						
Head circumference (cm)						
Incidence of illness episodes since last visit						
<u>Symptoms / signs:</u>						
<i>Diarrhoea</i>						
<i>Fever</i>						
<i>Ear discharge</i>						
<i>Cough</i>						
<i>Oral thrush or ulcer</i>						
<i>Skin rash</i>						
<i>Convulsions</i>						
<i>Other, please specify</i>						
Hospitalizations since the last visit						
Reason of hospitalization						

Information on other children

15 How many living children do you have?

- 15.1 1
- 15.2 2
- 15.3 3
- 15.4 4
- 15.5 4
- 15.6 6
- 15.7 7

16 Have any of your children died before age 5?

- 16.1 Yes (→ qu 17)
- 16.2 No (→ qu 18)

17 How many?

- 17.1 1
- 17.2 2
- 17.3 3
- 17.4 4
- 17.5 5

18 Has the child in the study been more ill than your other children?

- 18.1 Yes
- 18.2 No